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## Effectiveness of Adding Disposable Brush to the Surgical Scrub Routines in Reducing Hand Bacterial Flora

Association of Indonesian Surgery Nurses (HIPKABI)

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### Abstract

The surgical scrub is an important surgical site infection prevention method, however the optimal surgical scrub procedure is still a matter of debate. This research aims to study the effectiveness of adding this new disposable brush into surgery nurses' surgical scrub routines to reduce hand bacterial flora. The research involves thirty two surgery nurses, which are randomly assigned into two groups. The first group uses the new brush during surgical scrub routines while the second control group do not. A sample from surgery nurses' hands are taken before and after the surgical scrub procedure, then the number of colony forming units are counted by laboratory technician. Wilcoxon test is conducted to evaluate the difference of colony forming unit number before and after surgical scrubs in each group. Mann-Whitney test is conducted to evaluate the difference of colony forming unit number after surgical scrubs between the two group.

Surgical scrub procedure with or without the use of brush effectively reduce the number of hand bacterial flora. The addition of brush to surgical scrub routines do not provide significant benefit in reducing hand bacterial flora. The use of brush is recommended for dirty nail and cuticles, however it must be a asingle use and disposable.

**Keywords:** Surgical Scrub, Brush; germs.

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## **1. Introduction**

World health organization reported that there are 234 millions major surgeries carried out every year globally[1]. Considering the number of personnel participated in each surgery procedure, there are billions of surgical scrub done annually.

Surgical scrub is one of the most important means to prevent surgical area infection. However, the optimal surgical scrub procedure to reduce bacteria counts is still debated by researchers all over the world.

The center for disease control and prevention (CDC) recommends the usage of nail picks, but not nail brush, to clean underside of nails during surgical scrub[2]. The centre for health protection (CHP) recommends cleaning underside of nails before surgery, but do not give specific recommendation about brush, pick, or other tools [3] . WHO guidelines for hand hygiene recommends the use of nail pick to clean dirt on the underside of nails during surgical hand preparation [1].

In Indonesia, brushes are used to clean the tip of fingers during surgical scrub. It is especially important, because the region's high level of humidity increase the rate of bacterial growth.

Outside of the hospital, all surgical theater personnel are exposed to an environment with increased risk of bacterial transmission through hand contact (public transport, crowded areas, dusty areas, or rooms with limited ventilation). Personnel feel their hands are safer when they do surgical scrub with the addition of brush.

This research is aimed to compare the effectiveness of nurses' surgical scrub with and without brush in reducing bacterial colonies count.

## **2. Methods**

### ***2.1 Study design***

This is a prospective randomized controlled clinical trial comparing the effectiveness of surgical scrubs with brush (intervention group) and without brush (control group) with bacterial colony forming unit count as reference standard. Laboratory analysts are blinded to subjects' assigned grouping. The study protocol was approved and ethically cleared by our Institutional Review Board.

Every subject gave informed consent to participate in this study. Data analysis is done using non-parametric dependent Wilcoxon signed rank test to evaluate the difference of bacterial colony count before and after surgical scrubs; and non-parametric Mann-Whitney U test to evaluate the difference of bacterial colony reduction between intervention and control groups.

### ***2.2 Study location and time***

The study is done in surgical scrub area of operating theatres in Rumah Sakit Jantung dan Pembuluh Darah Harapan Kita through August-September 2017.

### **2.3 Study sample**

This study sample is active licensed surgical nurses who practise in Rumah Sakit Jantung dan Pembuluh Darah Harapan Kita. Subjects who are hypersensitive to chlorhexidine gluconate or have a wound on their hands are excluded from the study. This study enrolled 32 surgical nurses who gave informed consent for participation. Subjects are randomly assigned into two groups: intervention group and control group. Intervention group did surgical scrubs with brush while control group did surgical scrubs without brush.

Swab sample was taken from subject's fingertip before and after surgical scrub by laboratory technician. Blinded laboratory analysts counted the number of colony forming units. Surgical scrub protocol used are in compliance with guideline from of Himpunan Perawat Kamar Bedah Indonesia (HIPKABI)

### **2.4 Procedure**

#### **2.5 Tools and Materials**

##### **2.5.1 Intervening Group**

(with a *disposable scrub brush*, using T.Srub Brush Produced by PT.Triton Manufactures )

- a) A deep and wide sink to prevent the water to splash out
- b) Running water which qualifies the requirement, that can be adjusted by the elbow or foot.
- c) A brush and sponge with Antiseptic Chlorhexidine 4 % as well as a nail cleanser
- d) Antiseptic Chlorhexidine 4 %

Controlling Group (without a disposable scrub brush)

- a) A deep and wide sink to prevent the water to splash out
- b) Running water which qualifies the requirement, that can be adjusted by the elbow or foot
- c) Antiseptic Chlorhexidine 4 %

##### **2.5.2 Standard Procedure**

1. The hair has been covered by a complete APD (a cap, a masker, a pair of glasses, an apron, a special pair of shoes that has been wholly covered)
2. Short and hygienic nails with not nail polishes
3. Release the ring and watch, roll up the sleeves 10 cm above the elbow
4. There is no scar on the skin which can be infectious
5. Swab the cuticles before and after washing hands

**Table 1:** Surgical Scrub Procedure With and Without a Brush

<b>Surgical Scrub Procedure with a Brush</b>	<b>Surgical Scrub Procedure without a Brush</b>
<ol style="list-style-type: none"> <li>1. Choose the right antiseptic liquid</li> <li>2. Turn on the automatic or manual faucet with the elbow or foot</li> <li>3. Break the seal of a brush / sponge, then take turn cleaning the left nails to the right ones by using a nail cleanser , then throw away the cleanser</li> <li>4. Wash the hands and arms with running water which should reach 5 cm above the elbow</li> <li>5. Open the antiseptic liquid with the elbow (for hand pumping) or with the foot (for foot pumping) as much as 5 ml</li> </ol>	<ol style="list-style-type: none"> <li>1. Choose the right antiseptic</li> <li>2. Turn on the automatic or manual faucet with the elbow or foot</li> <li>3. Wash the hands and arms with the flowing water which should reach 5 cm above the elbow</li> <li>4. Take the antiseptic liquid with the elbow (for hand pumping) or with the foot (for foot pumping) as much as 5 ml</li> <li>5. Smear the whole surface of hands and arms with Chlorhexidine 4 %, smear it with a circular motion from the elbow to 5 cm above the elbow, then</li> </ol>
<p><b>Table 1. continuance</b></p>	
<p><b>Surgical Scrub Procedure with a Brush</b></p> <ol style="list-style-type: none"> <li>6. If an antiseptic sponge is used, squeeze the sponge to produce foam that will flow on the hands and arms.</li> <li>7. Smear the whole surface of hands and arms with Chlorhexidine 4 %, smear it with a circular motion from the elbow to 5 cm above the elbow (with a sponge on still on the hand)</li> <li>8. Brush the nails for one minute each</li> <li>9. Then throw away the brush, but the sponge on the hand is used to rinse the hands all the way to the elbows with the flowing water until the hands and arms are totally hygienic</li> <li>10. Smear the hands and ¾ of arms again with Chlorhexidine 4 %. Use the sponge to clean both the left and the right hand (brush the palm and and the back of the hand for fifteen seconds each, then brush all the nails, as if they had four sides, for thirty seconds). Brush each hand with a sponge for one minute and throw away the sponge, then rinse the hand to the elbow direction with the flowing water until the hands and arms are totally hygienic.</li> <li>11. Again smear only the hands to the wrist with Chlorhexidine 4 %, brush the hands based on the standard procedure of hand washing for one minute, then rinse both of the hands with the flowing water until the hands are totally hygienic</li> <li>12. Let the water flow from the hand to the elbow in order to prevent a contamination</li> <li>13. Turn off the faucet with the elbow or foot if the faucet is manual</li> <li>14. Maintain the position of the hands higher than the shoulders</li> </ol>	<p><b>Surgical Scrub Procedure without a Brush</b></p> <ol style="list-style-type: none"> <li>6. rinse them with the flowing water from the hands to the elbow direction</li> <li>7. Smear the hands and ¾ of arms again with Chlorhexidine 4 %. Use the sponge to clean both the left and the right hand (brush the palm and and the back of the hand for fifteen seconds each, then brush all the nails, as if they had four sides, for thirty seconds). Brush each hand with a sponge for one minute and throw away the sponge, then rinse the hand to the elbow direction with the flowing water until the hands and arms are totally hygienic.</li> <li>8. Again smear only the hands to the wrist with Chlorhexidine 4 %, brush the hands based on the standard procedure of hand washing for one minute, then rinse both of the hands with the flowing water until the hands are totally hygienic</li> <li>9. Let the water flow from the hand to the elbow in order to prevent a contamination</li> <li>10. Turn off the faucet with the elbow or foot if the faucet is manual</li> <li>11. Maintain the position of the hands higher than the shoulders</li> </ol>

### 3. Results

Bacterial colony forming unit count from 32 research subjects were described in table 2. (intervention group) and table 3. (control group).

**Table 2:** Bacterial Colony Forming Unit Count for Intervention Group

Subjects	Pre surgical scrub	Post surgical scrub	Category
1	48 Colonies	12 Colonies	Reduced
2	Full	Full	No change
3	Full	Full	No change
4	78 Colonies	Sterile	Reduced
5	Full	Full	No change
6	21 Colonies	8 Colonies	Reduced
7	Full	46 Colonies	Reduced
8	Full	12 Colonies	Reduced
9	Full	10 Colonies	Reduced
10	Full	53 Colonies	Reduced
11	Full	24 Colonies	Reduced
12	Full	Full	No change
13	Full	4 Colonies	Reduced
14	Full	Full	No change
15	32 Colonies	18 Colonies	Reduced
16	Full	76 Colonies	Reduced

From the table 2, out of 16 subjects in intervention group, 11 (68.75%) shows reduced bacterial colony forming unit counts a few moments after surgical scrubs.

**Table 3:** Bacterial Colony Forming Unit Count for Control Group

Subjects	Pre surgical scrub	Post surgical scrub	Category
1	Full	57 Colonies	Reduced
2	Full	66 Colonies	Reduced
3	Full	Full	No change
4	Full	21 Colonies	Reduced

**Table 3.** Continuance

Subjects	Pre surgical scrub	Post surgical scrub	Category
5	Full	Full	No change
6	56 colonies	30 Colonies	Reduced
7	26 colonies	11 Colonies	Reduced
8	Full	Full	No change
9	Full	40 Colonies	Reduced
10	Full	3 Colonies	Reduced
11	Full	Full	No change
12	Full	Full	No change
13	Full	Full	No change
14	6 colonies	Sterile	Reduced
15	Full	Full	No change
16	Full	Full	No change

Based on Table 3, Out of 16 Subjects in control group, 8 (50%) shows reduced bacterial colony forming unit count after surgical scrubs. Both group does not show normal distribution. Non-parametric statistical test were done to evaluate the results. Full culture plates are considered to be 100 colonies.

**Table 4:** Median Comparison Of Bacterial Colony Forming Units Count Median Before and After Surgical Scrub

<b>Variabel</b>	<b>Before Surgical Scrub</b>	<b>After Surgical Scrub</b>	<b>p- Value</b>	<b>Bacterial Colony Reduction (%)</b>	<b>Count</b>
Surgical scrub with brush (intervention group)	86.18 ± 6.77	47.68 10.34	± 0.003	44.67	
Surgical scrub without brush (control group)	86.75 ± 7.48	64.25 10.12	± 0.012	25.93	

Based on Table 4, There is a significant decrease of bacterial colony forming unit counts in both intervention and control group ( $p = <0.01$  and  $0.012$  respectively).

#### 4. Discussion

In this study, surgical scrub with brush shows 44,7% reduction of bacterial colony forming units while surgical scrub without brush shows 25,9% reduction, although there are no significant difference statistically between the two groups ( $p = 0.151$ ). This shows that both approach are equally effective in reducing bacterial colony forming units count.

Similar research shows that there are no difference in bacterial count reduction between groups doing surgical scrub with brush and without brush, they are not recommend adding brush to routine surgical scrub because it does not increase effectiveness but do increase costs[5-8]. If hard edges brush is used, there may be a significant chance of skin erosion, while the effectiveness itself is limited.

WHO guideline on Hand Hygiene in Health care allows the use of brush but only for nails and cuticles, only when it looks dirty, however the brush must be sterile and disposable. Specially designed brush (smooth edges) may not cause skin erosion, and can be use to brush fingertips effectively to reduce bacteria between nails[9]. Further research is needed to evaluate the relationship between surgical scrub with brush and skin erosions.

#### 5. Conclusion

Surgical scrub procedure with or without the use of brush effectively reduce the number of hand bacterial flora. The addition of brush to surgical scrub routines do not provide significant benefit in reducing hand bacterial flora. The use of brush is recommended for dirty nail and cuticles, however it must be a single use and disposable.

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## **Conflict Interest**

The authors declare that they have no competing interests.

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